letters dated 8 May, 1967
27 June, 1967.

DRAFT

POLAR RESEARCH IN GEOLOGY

Part I Manpower

The 38 institutions reporting indicate a total of 62 professional level department members who are now, or who have been in the past, active in polar work. 119 were indicated as the total figure qualified to participate if all were given the opportunity. Of the 1372 graduate students reported, 3% have done or are doing polar work in the field of geology (exclusive of glaciology).

Part II Facilities

1. Only 21% of the departments reporting indicate special equipment for polar research. These include:

U. ARIZONA - carbon 14 lab (gas counting); potassium-argon age lab; nucleonic equipment; nuclear reactor.

U. GEORGIA - access to 650 computer; relatively complete photogrammetric equipment including Kelsh Stereoplot and Saltzman projector.

U. KANSAS - 100 Curie Cobalt 60 gamma radiation source for radiation damage studies in rocks or ice; specially insulated containers for transporting cold samples from polar areas; apparatus for measuring thermoluminescence.

U. COLORADO - adjacent high mountains with polar environment!

OHIO STATE - cryogenic laboratory, ultra low temperatures and measurement; large photogrammetric lab including

Wild A-7 Plotter; cold room (2 units, 300 ft.^{2}) expected in 1960.

TUFTS - polar field equipment.

U. MICHIGAN - cold room laboratory; polar field equipment.

PURDUE - Kelsh photogrammetric plotter; cold room lab; materials testing equipment.

2. The State University of Iowa reports a reprint library covering most of the significant papers in stratigraphy and paleontology of polar areas, and the University of Michigan has the Hobbs collection of polar works. The polar library facilities of the 38 institutions fall into the following classification: 26% report a departmental library which keeps most classical and present polar books; 42% rely on the usual polar publications kept in the general library; 21% have very limited polar library facilities; 5% report none.

3. 37% of the departments indicate special collections, which are as follows:

PURDUE - selected aerial photographs of permafrost terrain; Kodachrome and black and white slides of oblique and ground photographs taken in Alaska and Canada during summers 1947-1951 (est. 3,000); negative and photo print file of Alaska and NWT Canada (est. 6,000); collection of rocks from Arctic.

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U. MICHIGAN - aerial photos of deformation area, Foss Ice

Shelf, Antarctica; Antarctic rock weathering suite collected from Marble Point with some thin sections.

TUFTS - Antarctic rocks.

U. MINNESOTA - small Mesozoic arctic ostracod collection; fairly large collection Quaternary ostracods from NPR #4 on loan from U.S.G.S; Antarctic rock and mineral collection possible.

OHIO STATE - rock sample collections; fossil collections; photogrammetric plates; field notebooks.

SYRACUSE - Antarctic rock specimens collected by E.T. Apfel in 1948.

U. COLORADO - biological collections; mainly lichens.

U. KANSAS - collection related to thermoluminescence studies.

DUKE - Antarctic coal samples.

STATE U. of IOWA - fossil collections from Queen Elizabeth Island, Greenland, Hudson Bay area, and Arctic slope.

CARLETON - 200 erratics collected by British Antarctic 1907-09 Exped. from Cape Royds, Ross Island; some thin sections of Antarctic rocks.

HARVARD - small collection Ord. trilobites from Baffin Island. Collection of Hecla Hoek rocks from western Spitsbergen. Small collection of Sil. trilobites from Cornwallis Island.

U. WYOMING - One small collection Sentinel Mtns., Antarctic from IGY traverse.

U. GEORGIA - extensive map collection.

Part III Curriculum

1. The majority of the departments offer a basic course in Glacial Geology and in Geomorphology, but polar problems do not constitute a major portion of the course material. Syracuse U. has just added a course in Glacial and Pleistocene Geology to their curriculum which will be given for the first time during spring semester, 1960 by Prof. E.H. Muller. Two schools, Missouri School of Mines and Metallurgy and Purdue University, offer courses of direct concern to polar work. These are:

MISSOURI SCHOOL MINES & METAL. - Glaciology; 3 grad students; given once every 3 terms by Prof. J.C. Maxwell.

PURDUE - Engineering Uses of Aerial Photography; 10 grads, 2 undergrads; fall and summer; Prof. R.D. Miles (airphoto interpretation of soils, rocks, landforms, and permafrost). Engineering Materials of N. A.; 15 grads, 5 undergrads; given once a year by Prof. K.B. Woods.

The University of Minnesota notes that a section on frost processes is included in the course Glacial and Geomorphology, and the University of Wisconsin indicates that polar areas and problems are stressed in the Glacial and Geomorphology course offerred by Prof. R.F. Black.

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2. Four departments (11%) are contemplating expansion into polar areas and problems:

U. GEORGIA - considering an advanced/graduate course or sequence in physical geography of polar areas, e.g. geomorphology plus climatology.

U. NEBRASKA - considering seminar on Antarctic on the graduate level.

OHIO STATE - considering a polar seminar on the graduate level.

YALE - expressed possibility of considering such within a year.

3. The 38 departments report a total of 18 theses completed in polar areas within the past five years. On the master's level, U. Michigan had 3, Ohio State 3, and U. Wyoming 1. On the Ph.D. level, Northwestern had 1, Purdue 1, U. Michigan 1, U. Wisconsin 1, U. Minnesota 1, Ohio State 1, U. Colorado 1, and Harvard 4.

4. Current theses in polar research total 16, with U. Kansas indicating one possibility. On the master's level, Ohio State reports 2, U. Colorado 1, and U. Wyoming 2. On the Ph.D. level, Purdue has 1, U. Michigan 2, U. Wisconsin 3, U. Minnesota 2, Ohio State 2, and Yale 1.

5. A total of 47 graduate students are reported with polar experience which was gained in the following manner: 19% connected with IGY; 40% from other government sponsored expeditions; 30% with private expeditions; and 11% from

other sources (military and summer employment on arctic slope with Shell Oil and Mobil Oil of Canada).

Part IV Research Activities

1. 32% of the departments reporting indicated current polar research underway. The institutions and their projects are summarized as follows:

BOSTON U. - Permafrost Patterned Ground; supported by personal fund of Enzmann; data gathered by Enzmann during military and geological expeditions to Greenland and Canada.

HARVARD - Geology of Western Spitsbergen-- a series of investigations by D.J. Atkinson involving to date 4 years work; field work supported by grants from British sources; invaluable logistic support given by Norsk Polarinstitutt.

YALE - Geology of Anaktuvuk Pass area, Brooks Range, Alaska. Funds from AINA; 2 years; Arctic Research Lab provided logistics.

U. UTAH - Summary of Geology of Arctic - no funds needed.

DUKE - Antarctic Coal Spores; funds from personal and departmental sources; logistic support provided personally.

U. KANSAS - Antarctic research; funds from NSF for 1 year; logistics by U.S. Navy. In September 1959 the U.S. Air Force provided transportation and support for making collections of limestone at Ward Hunt Island in Arctic.

U. NEBRASKA - NSF grant for petrographic work on specimens collected during IGY. Will run til completed.

OHIO STATE - Antarctic Data Reduction (IGY)-- includes 1/4 hardrock geology, 1/8 glacial geology; supported by NSF, 1958-60; logistics by U.S. Navy in field.
Antarctic Data Reduction (IGC); 1960-61.
Spitsbergen, Glacial Geology (IGY), 1959-61; Swedish IGY Committee.

U. MINNESOTA - Bedrock Geology of Certain Nunatak areas in Antarctica; funds from NSF; 4 years; U.S. Navy.

U. WISCONSIN - North American Stratigraphy; funds from Humble Oil So; commercial logistic support.

TUFTS - Antarctic expedition; funds from NSF and Tufts; 3 month field season; logistic support VX-6, U.S. Navy.
Shallow Water Sedimentation in the Vicinity of Barrow, Alaska; funds from AINA and ONR for summer of 1960; logistics from Arctic Research Lab.

U. MICHIGAN - Antarctic Rock Weathering; funds from NSF; one field season (1958-59); logistics from U.S. Navy.
Geomorphology of Sortehjorne Area, Northeast Greenland; support by AINA for 2 summers in field (1959-60); logistic support from a private mine in the area, very satisfactory.
Geology of the Romanzof Mountains, NE Alaska. Funds from USGS and AINA; logistic support from Arctic Research Lab-- problems in communication, no radios. 2 summers in the field (1957-58).

Ross Ice Shelf Deformation Project, Antarctica-- structural deformation and ice shelf movement, stratigraphy and petrofabrics, initiated during IGY; funds from NSF through Ohio NSF Data Reduc. Center; logistics provided by U.S. Navy.

Continental Cenozoic Stratigraphy and Vertebrate Paleontology of Alaska; funds for 1½ months in field provided by Univ. Michigan Research Institute; logistics will be private; summer 1960.

2. 40% of the 38 universities completed projects in polar areas during the past five years:

PURDUE - Soils Along the Route of Quebec Northshore and Labrador Railroad; funds from QN & L R. R.; 2 years; logistic support from Purdue. Freeze Study of Soils; funds from SIPRE; 3 years; support by Purdue.

U. OKLAHOLMA - Operation Mint Julep; led by L. R. Wilson on Greenland Ice Cap.

TUFTS - Antarctic Geomorphology; funds from IGY, Nov. 1958-Feb. 1959; logistics by VX-6, U.S. Navy.

Engineering Geology, Antarctica; supported by U.S. Navy, Nov. 1957-Feb. 1958; logistics VX-6, U.S. Navy.

U. WISCONSIN - North American Stratigraphy (a portion has been completed each year for past four years); funds from Humble Oil Co; commercial support.

North American Iron Deposits (a portion has been completed three of the past five years); funds from Jones-Laughlin

steel Co. and U.S. Steel Co; commercial support.

North American pegmatites and manganese deposits; funds from Union Carbide Co; commercial support.

U. MINNESOTA - Glacial History of Black River Area, NWT Canada; funds from U. Minn. Nat. Hist. Museum, Geol. Soc. Amer, contract support.

Patterned Ground near Thule, Greenland; SIPRE, U.S. Army Engineers provided support.

Ice in Certain Geological Environments; library research; 3 years;

Ostracods from Quaternary Gubik formation, Naval Petroleum Reserve No. 4, Alaska; funds from USGS, Grad School, U. Minnesota.

OHIO STATE - Nunatarssuaq Scientific Studies; funds from USA Transportation Corps; 1953-54; logistics by Transportation Corps; about 60% hard rock and surficial geology.

Ice Cliff Studies in Nunatarssuaq, Greenland; funds from SIPRE lab; 1955-57; about 15% surficial geology; logistics by Corps of Engineers, U.S. Army.

SYRACUSE - San Rafael Glacier and Glacial Chronology, southern Chile (E.H. Muller); funds from Amer. Geog. Soc; field work Jan-Feb. 1959, reports completed 1959; support by NSF-ONR.

Description and Regimen, Knife Creek Glaciers, Mt. Katmai, Alaska; funds from USGS and U.S. Nat. Park

Service; field work in June and August 1953, reports completed in 1957.

U. COLORADO - Field and laboratory research on Quaternary geology of arctic Alaska; sponsored by USAF, 1952-56.

U. NEBRASKA - Dr. S. B. Treves was research assistant at IGY Data Reduction Center, Columbus, Ohio-- aided in preparation of reports on Dufek Massif; summer 1958. He was also research associate at IGY Data Reduction Center, Columbus, summer of 1959-- aided in preparation of reports on Wilkes Station, Horlick Mtns. (petrography).

U. KANSAS - Antarctic field work, 1958-59; funds from AINA, U.S. Atomic Energy Commission, and U. of Kansas.

STATE U. of IOWA - Ordovician cephalopod fauna of Baffin Island. Funds from Grad. College and F.O. Thompson; logistics by Canadian Geol. Surv. and F.O. Thompson.

Ordovician conodonts from Northern Manitoba; Grad. Coll; specimens collected privately.

Stratigraphy of Portions of Devon, Ellesmere, Axel Heiberg, Lougheed and Bathurst Islands. Funds and logistics from Canadian Geol. Surv.

Some Mississippian Ammonoids from Northwest Canada (Yukon Territory, and Northern British Columbia). Funds from Grad. Coll. Support from U. of Alberta.

CARLETON COLL. - Petrography of some erratics from Cape Royds, Ross Island, Antarctica. Funds from Geol. Soc. of Amer; Louis W. and Maud Hill Family Foundation.

Petrology of Antarctica; funds from Louis W. and Maud

Hill Family Foundation.

HARVARD - Genesis of chloritoid, Spitsbergen-- part of continuing program in western Spitsbergen. Completed in 1956.

Structure of the Hecla Hoeck of Prince Charles Foreland, Spitzbergen. Completed in 1959 for presentation at XXI International Geol. Congress.

Tertiary Sedimentation in Spitsbergen (ready for publication).

Ordovician Trilobites from Baffin Island-- no funds were available. Results published by GSA.

U. MICHIGAN - Preliminary Report on Ross Ice Shelf Deformation Project, Antarctica; funds from IGY; completed 1958.

Geologic Structures of the Ross Ice Shelf, Antarctica; completed in 1959 for presentation at XXI International Geol. Congress.

BOSTON U. - Study of Ice Platterns, 1954-1957.

3. 8 institutions (21% of those reporting) have proposals for polar research within the next two years in geology:

HARVARD - Prof. Whittington has agreed to help in study of Cambro-Ordovician fossils to be collected from Devon Island by expeditions sponsored by AINA. He also expects to have graduate student working on Siluro-Devonian fossil collections from Bathurst Island. Prof. Atkinson expects to complete studies of Hecla Hoek stratigraphy and Tertiary structure of western Spitsbergen.

He proposes further field work there in 1961. Funds and logistic support have not yet been sought.

CARLETON COLL. - has submitted a request for Deep Freeze IV dredgings to be investigated at Carleton.

U. KANSAS - a continuation of present Antarctic program will be proposed to NSF. Some expansion in operations and a larger budget will be necessary. Dr. Zeller states that logistic support during the IGY field season of 1958-59 in Antarctica was not satisfactory. He cites a "very great improvement" in logistic support in the 1959-60 season.

U. NEBRASKA - Dr. Treves proposes to visit and collect material from Horlick Mtns. with a group primarily from Ohio State U.

OHIO STATE - proposal to NSF to study Antarctic Horst Geology. Logistics will be by U.S. Navy.

U. MINNESOTA - Geomorphic Features of Certain Dry-Land Areas in Antarctica. Application to NSF for 3 field seasons; logistics by Navy.

Geology of Certain Nunataks in Antarctica. Proposal to NSF for 3 field seasons - support by U.S. Navy.

J.C. Craddock and 2 Ph.D. students are now in field in Antarctica outlining and starting work on problems to be followed for several years.

U. WISCONSIN - Proposal to NSF for Patterned Ground in Antarctica; 3 years; logistic support commercial and U.S. Navy.

Proposal to NSF for Glacial Geology of Beardmore Glacier System, Antarctica; 3 years; commercial and U.S. Navy support.

Stratigraphic Paleontology of the world, including polar areas; funds to come from Humble Oil Co; project will run indefinitely; support commercial.

TUFTS - Dr. Nichol's future work in Antarctic not reported. Support from VX-6, U.S. Navy "very fine."

4 other institutions are interested in or contemplating activity in polar research as follows:

BOSTON U. - Dr. Enzmann expresses interest in working on another military project which would allow some observation of patterned ground.

U. WISCONSIN - seriously contemplating or in the planning state on: 1) economic geology in Antarctica; 2) petrology and structure of Canadian arctic barrens; 3) mineral deposits in arctic Canada.

U. MICHIGAN - a graduate student has expressed interest in doing paleontological research in the Antarctic. Presently exploring possibilities of joining American or British expedition which would take him to an area favorable for paleontological studies.

It is hoped that the Research Institute will support further field research on stratigraphic and paleontological problems in Alaska.

and conodonts if specimens are provided, or if one of the staff members is able to join an Arctic field party for the purpose of collecting such material.

4. Present deficiencies in geological polar research are commented on as follows:

DUKE - Dr. E.W. Berry comments on his lack of enough diversified coal samples from the Antarctic in connection with his Southern Hemisphere spore report.

U. WISCONSIN - "(Spot) studies are woefully inadequate to resolve the multitudinal problems in geology peculiar to polar areas." Greatest hinderances according to Dr. R. F. Black: 1) lack of funds which permit the better men to undertake research problems in polar areas instead of working commercially in the temperate regions; and 2) logistics-- especially those that permit the busy man to accomplish something besides living.

OHIO STATE - Dr. Goldthwait states the greatest needs as: 1) continuity of program and support; 2) trained older leaders-- there are many young workers; 3) improved logistics in which scientific objective dictates policy, not military operation. More advanced planning.

U. KANSAS - Better laboratory facilities are needed so that measurements can be made in the Antarctic rather than transporting samples from the field to the university laboratories.

STATE U. of IOWA - All staff members have expressed interest

in Arctic research. Due to heavy cost of such field investigation in Arctic areas, however, they report little prospect of initiating further field work in the forseeable future.

BOSTON U. - the main limitation to polar research is given as funds.

CARLETON COLL. - will require funds for the thin sectioning of specimens if they receive the Deep Freeze IV rocks.

HARVARD - Two areas of insufficient knowledge are pointed out: 1) studies of fossil faunas from Arctic regions are few. Collections of fossils need to be made by paleontologists, not incidentally by specialists in other fields; 2) structural and stratigraphic data from Arctic and Antarctic regions are scanty. Detailed investigations of areas presently known only at reconnaissance level are needed.

SYRACUSE - a comment on calibre of researchers needed. Efforts should be made to interest mature metamorphic petrologists who have had reasonably extensive experience in the interpretation of metamorphic rocks to conduct studies on the structure of glacier ice. Teams of metallurgists and metamorphic petrologists would be even better.

PURDUE - suggested that a statistical study of type, density, and arrangement of polygons as indicators of soil and ice conditions as recorded on medium scale aerial photographs and engineering design problems associated with polygonal ground would be useful.